Very Preterm Birth and Parents' Quality of Life 27 Years Later

Dieter Wolke[ab], PhD, Dr. rer. nat. h.c., Nicole Baumann[a], BSc., Barbara Busch[c], MD, Peter Bartmann[c], MD, Dr. rer. nat.

Affiliations
[a]Department of Psychology, University of Warwick, Coventry, United Kingdom
[b]Division of Mental Health and Wellbeing, Warwick Medical School, University of Warwick, Coventy, United Kingdom
[c]Department of Neonatology, University Hospital Bonn, Bonn, Germany

Corresponding author: Dieter Wolke, Department of Psychology, University of Warwick, Coventry CV4 7AL, United Kingdom, +44 24 7657 3217, D.Wolke@warwick.ac.uk

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Abbreviations: GA – Gestational age; SES – Socio-economic status; VP/VLBW – Very Preterm (<32 weeks gestation) /Very Low Birth Weight (birth weight <1,500g); BLS – Bavarian Longitudinal Study; WHOQoL-BREF - WHO Quality of Life instrument, short edition; SWLS - Satisfaction with Life Scale; K-ABC - Kaufman Assessment Battery for Children

Table of Contents Summary. *This longitudinal study finds that very preterm birth does not lower parents' quality of life in the long term*

What's Known on This Subject: Very preterm birth is associated with increased disability and schooling problems. Parents of preterm children are more stressed in the first year after preterm birth and report more burden still when their preterm children reach adolescence.

What This Study Adds: Parents of preterm adults do not consider their quality of life (QoL) as poorer than those of term born. Poor child peer relationships and mental health problems but not prematurity or disability predict poorer parent OoL in the long term.

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Contributors' Statements:

Dieter Wolke: designed, conceptualized, and supervised the Bavarian Longitudinal Study and adapted the relevant instruments, participated in analyses and interpretation of data, drafted and revised the manuscript, and approved the final manuscript as submitted.

Nicole Baumann: coordinated data preparation, analysed and interpreted the data, drafted and revised the manuscript, and approved the final manuscript as submitted.

Barbara Busch: responsible for data acquisition, critically revised the manuscript, and approved the final manuscript as submitted.

Peter Bartmann: designed and conceptualized the Bavarian Longitudinal Study, critically revised the manuscript, and approved the final manuscript as submitted.

All authors are accountable for all aspects of the work.

Abstract

Background and Objectives.
Parents of preterm children experience increased distress early in their children's life. Unknown is whether quality of life of parents of preterm born children is comparable to that of parents of term born children by the time their offspring reaches adulthood. What precursors in their offspring's childhood predict parental quality of life?

Methods.
A prospective whole population study in Germany followed very preterm or very low birth weight (<32 weeks gestation/<1500g, VP/VLBW) (N=250) and term born individuals (N=230) and their parents (VP/VLBW: N=219, term: N=227) from birth to adulthood. Parental quality of life was evaluated with the WHO Quality of Life and the Satisfaction with Life questionnaire when their offspring were adults (mean age 27.3, 95% CI: 27.2, 27.3). Childhood standard assessments of VP/VLBW and term born offspring included neurosensory disability, academic achievement, mental health, parent-child and peer relationships.

Results.
Overall quality of life of parents of VP/VLBW adults was found to be comparable to parents of term born individuals ($p>0.05$). Parental quality of life was not predicted by their child being born VP/VLBW, experiencing disability, academic achievement or parent-child relationship in childhood, but by their offspring's mental health (B=0.15, 95% CI: 0.08, 0.22) and peer relationships (B=0.09, 95% CI: 0.02, 0.16) in childhood.

Conclusions.
As a testament to resilience, parents of VP/VLBW adults had comparable quality of life to parents of term born adults. Support and interventions to improve mental health and peer relationships in all children are likely to improve parents' quality of life.

Introduction

Being born very preterm or with very low birth weight (VP/VLBW) is associated with a highly increased risk of mortality, neonatal complications, long term morbidity[1] and costs.[2] Medical achievements such as an increased number of children surviving with chronic conditions may have hidden consequences for health and quality of life of parents.[3] Having a child born VP/VLBW increases parental stress and mental illness symptoms during the first seven years of life.[4-8] The neonatal difficulties that the children encounter[7,9] and their physical, emotional and social problems have been reported to mediate the link between preterm birth and parental stress.[10]

There is increasing evidence that motor,[11] cognitive[12] and mental health problems[13] after VP/VLBW birth persist into adulthood. Adults born VP/VLBW are less likely to live independently, more often receive social benefits, have periods of unemployment and are less likely to find a romantic partner[14,15] than term born controls. Thus their transition into adulthood is more challenging and their self-reported quality of life is lower than that of term born adults.[16] These long term consequences of VP/VLBW birth may also affect the quality of life of their parents even when their offspring are adults.

To date only a few studies investigated parental psychological distress and burden as their VP/VLBW offspring transitioned into adolescence. Some found continued higher family burden and stress[17,18] and adverse effects on parents emotional functioning.[19] Those parents who had adolescents with significant developmental difficulties reported to be more burdened and stressed.[17] Only one study to date followed VLBW and control parents when their children reached adulthood. They found that differences in burden had ameliorated by the time of adulthood but it had curtailed the parents' job opportunities.[20] While there is some indication that burden continues for parents of VP/VLBW at least into adolescence, there is complete paucity of findings on the parents' quality of life and life satisfaction when their

VP/VLBW children reach adulthood. Unknown is also which developmental difficulties in childhood may affect parental quality of life in the long term. This information is, however, important to evaluate the full range of consequences of VP/VLBW birth, direct resources appropriately and counsel parents about the long term effects of VP/VLBW on their life.[21] The aims of this prospective cohort study were, to assess the quality of life of parents of adults who were born VP/VLBW compared to parents of term born offspring, and to investigate what factors in childhood predict quality of life of parents of VP/VLBW and term born when they reach adulthood.

Methods

Study Design and Participants

The Bavarian Longitudinal Study (BLS) is a geographically defined prospective whole population study of VP/VLBW and term born individuals in Germany born between January 1985 and March 1986.[12] The offspring and parents (major caretaker) of VP/VLBW (mothers: N=192; fathers: N=27) and term controls (mothers: N=212; fathers: N=15) were assessed seven times since birth of their offspring. For this study parents were contacted and asked to fill in questionnaires on their quality of life and life satisfaction when the young adults were around 27 years of age (mean age 27.3, 95% CI: 27.2, 27.3). In total, data on parents' quality of life and life satisfaction were available for 446 parents (VP/VLBW: 219 parents of 250 offspring (due to multiple births); term controls: 227 parents of 230 offspring) (Figure 1). Ethical approval for this study was granted by the Ethical Board of the University Hospital Bonn, Germany (reference # 159/09). Parents gave fully informed written consent for their participation and the participation of their children in childhood. Adolescents (13 year assessment) gave own written consent to their participation.

Measures

Parental Quality of Life

The German version of the WHOQoL-BREF (WHO Quality of Life instrument, short edition)[22,23] was administered to assess parental quality of life. The WHOQoL-BREF has excellent validity[22], is composed of 26 items and assesses quality of life profile across four domains: physical health (seven items), psychological (six items: e.g., "How often do you have negative feelings such as blue mood, despair, anxiety, depression?"), social relationships (three items: e.g., "How satisfied are you with your personal relationships?"), and environment (eight items). In addition a global assessment of an individual's perception of quality of life and general health is computed (two items: e.g. "How would you rate your quality of life?"). The raw scores of the WHOQoL-BREF were transformed into scores ranging between 0-100, where a higher score denotes higher quality of life (VP/VLBW parents Cronbach's alpha (term control parents in brackets): physical=0.81 (0.85), psychological=0.79 (0.74), social relationships=0.64 (0.66), environment=0.76 (0.74), global=0.70 (0.65)).

Parents further answered the 5-item Satisfaction with Life Scale (SWLS)[24] , also reported to have high validity and reliability.[25,26] The items were: "In most ways my life is close to my ideal", "The conditions of my life are excellent", "I am satisfied with my life", "So far I have gotten the important things I want in life", "If I could live my life over, I would change almost nothing". Items are rated on a 7-point scale (1=*strongly agree* to 7=*strongly disagree*) and summarized into a global life satisfaction score (VP/VLBW parents: *Cronbach's alpha*=0.91; term control parents *Cronbach's alpha*=0.90).

The global life satisfaction score, the four WHOQoL domain scores and the global score of quality of life were highly correlated (r =0.42 to 0.75). To avoid inflation of significant

results using multiple individual domain comparisons, the five WHOQoL and the Life satisfaction scale were entered into a confirmatory factor analysis using Mplus Version 7.3 [27] yielding a single overall parental quality of life score (factor loadings in Supplementary Table S1). The standardized factor score, representing overall parental quality of life, was retrieved.

Assessment of Child Functioning

Child functioning in five areas were assessed with multiple measures during childhood. Supplementary Table S2a,b provides a fully referenced and detailed description of all measures.

Disability in childhood was defined as having cerebral palsy, blindness, non-corrected hearing problems, motor problems or cognitive impairment at the ages of 6 or 8 years.

Mental health was measured with parent reports in the Child Behavior Checklist at 6 and 8 years and parent and child reports in the Strengths and Difficulties Questionnaire at 13 years (four measures).

Academic achievement measures included the K-ABC achievement subtest at 6 and 8 years, tests of mathematics, reading and spelling at 8 years, and child school success at 13 years (six measures).

Parent-child relationship was assessed with nurses' observations of parenting neonatally and observations of maternal sensitivity at 6 and 8 years (three measures).

Peer relationships were measured using parent and child reports of number of friends during interviews at 6 and 8 years and parent and child report of the quality of peer relationships assessed with the Pictorial Scale of Perceived Competence and Social Acceptance at 6 and 8 years (eight measures).

To obtain domain scores of mental health, academic achievement, peer relationships, and parent-child relationship from the various childhood measures we performed confirmatory

factor analysis for each domain using Mplus Version 7.3 [27]. Measures were used as factor indicators and standardized factor scores for each of the four child functioning domains, were retrieved. All factor loadings above 0.3 were included (see Supplementary Table S3).

Potential Confounders

The following variables were considered as potential confounders: parental sex, family socioeconomic status at birth classified as low, middle, and high,[28] maternal major depression diagnosed according to DSM IV at 6 [29] or 8 years, maternal age, marital status at birth, and multiple birth.

Statistical Analysis

All analyses were conducted using SPSS Version 22. Differences between parents of VP/VLBW and term control adults, and between offspring groups were tested with t-test or chi-square test. Multiple comparisons were Bonferroni adjusted.

In order to predict overall parents' quality of life, VP/VLBW birth, child disability, and the domain scores for mental health, academic achievement, parent-child relationship and peer relationships were entered in univariate regression analyses. For parents with multiples mean child functioning domain scores were used. Disability was regarded as present if one of the multiples had a disability. Subsequently, to examine which child functioning domains were most strongly associated with the outcome, all child functioning domains and potential confounders were entered simultaneously in the regression model.

Regression analyses were repeated separately for the six original parent quality of life outcome scores.

Results

Family demographics and child functioning

Participating parents of VP/VLBW adults were more often fathers compared to parents of term born adults (Table 1). More fathers of VP/VLBW adults were divorced or widowed than fathers of term born controls. Parents of VP/VLBW individuals had less often a high socioeconomic status than parents of term born individuals. No group differences were found for current parental age, maternal age or marital status at birth. Maternal clinical depression during their offspring's childhood was more frequent for parents of term born controls.

By definition, VP/VLBW offspring were born with lower gestational age and birth weight, and were more often multiple births than term born controls, no group differences were found with regard to sex. In childhood, VP/VLBW offspring had more disabilities, more mental health problems, lower academic achievement, and worse parent-child and peer relationships than term born comparisons (Table 1).

Participants compared to those lost to follow-up

Participating parents of VP/VLBW adults did not differ from parents of VP/VLBW who dropped out in terms of maternal and paternal age at birth, and maternal depression when their children were aged 6 or 8 years (Supplementary Table S4). However, dropouts were more often socially disadvantaged (low family SES: 48.0% vs. 30.3%, $p = 0.002$) and less often married or cohabiting with a partner at the time of birth of their child (87.3% vs. 94.3%, $p = 0.019$).

Participating parents of term control adults were not different regarding marital status at birth or maternal depression at 6 or 8 years compared to dropout term parents. Parents of term control adults who dropped out, however, were more often socially disadvantaged (low family SES: 44.9% vs. 25.6%, $p = 0.002$) and younger at the time of birth of their child

(mean maternal age: 27.2 [95% CI: 26.0, 28.4] vs. 29.1 [95% CI: 28.5, 29.7]; mean paternal age: 30.5 [95% CI: 29.1, 31.8] vs. 32.4 [95% CI: 31.6, 33.2]).

VP/VLBW offspring did not differ in terms of sex, gestational age and birth weight from dropouts (Supplementary Table S4). Dropout VP/VLBW adults were less often multiples compared to VP/VLBW who participated (18.6% vs. 29.2%, $p = 0.016$).

No differences were found between term offspring and dropouts.

Parental quality of life and their offspring's childhood functioning

The overall Quality of Life (factor) score of parents of VP/VLBW and term born offspring was not different (VP/VLBW: mean standardized factor score -0.02 [95% CI: -0.13, 0.08], term controls: mean standardized factor score 0.02 [95% CI: -0.07, 0.12], $p > 0.05$) (Figure 2). Table 2 shows the individual scale scores. There were no group differences for the four quality of life domain scores and global life satisfaction and global score of quality of life and health perception (Bonferroni corrected p>0.008). As there were more fathers in the VP/VLBW group we repeated analysis using a 2 x 2 ANOVA with parent sex and prematurity as factors. Quality of Life (factor) did not vary according to sex, prematurity and the interaction effect of parent sex X prematurity was also not significant (overall model: df (3); F=0.79; p=.50).

Of the five offspring's childhood domains of functioning, better mental health and better peer relationships in childhood were consistently predictive of higher overall parents' Quality of life (factor) score in unadjusted and adjusted analyses (Table 3). Detailed analyses of the five WHOQoL and the Life satisfaction scales are shown in Supplementary Table S5.

Discussion

This study found that quality of life of parents of VP/VLBW offspring who had reached adulthood was not different from that of parents of term born children. We also showed that better offspring's mental health and peer relationships in childhood, independently of whether born VP/VLBW or term, predicted parents' quality of life still more than a decade later. VP/VLBW children more often experience disability,[30] mental health[31] and academic achievement problems[32] and poorer peer relationships[33,34] in childhood than those born at term. This was confirmed in this prospective study of a geographically defined sample in Germany (Table 1). Despite the increased stress in the initial years[8,9] and the challenges faced by parents of VP/VLBW adults who are still more likely to have neurodevelopmental [12,35] problems and difficulties with adaptation into independent living in adulthood,[14,16] their comparable quality of life to those of parents of term born adults is a testament to their resilience. The findings are comparable to the only other study of extremely low birth weight parents compared to term controls[20] in Canada that detected no differences in maternal health and functioning. It suggests that in countries with universal access to health care such as Germany and Canada, despite other cultural and educational differences, parents of VP/VLBW children show, on average, remarkable ability to cope with the challenges presented to them.

Furthermore, consistent with the study by Saigal and colleagues,[20] we found that disability - despite the many sacrifices parents had to make to care for their disabled child - did not reduce the quality of life of their parents when their offspring became adults. Similarly, academic performance in childhood and the parent-child relationship did not predict parents' quality of life more than a decade later.

In contrast, lower mental health and poor peer relationships in childhood predicted lower quality of life of parents. In other words: parents feel better about themselves and their relationships when their offspring had friends and were happy during childhood. This is

likely to be due to the long term adverse effects that both childhood mental health problems and social relationships can have on adult functioning. Both mental health problems, even when subclinical [36,37] and being bullied, socially excluded and without friends [38] has been shown to have long lasting effects on adult adaptation such as social relationships, partnering, wealth and independent living. These affect the health-related quality of life of adults born VP/VLBW or at term [16] and are also, as shown here, reducing the quality of life of parents.

This study has a range of strengths, the most important being the long-term follow-up of a large whole population sample of VP/VLBW and term-born individuals recruited in the same obstetric hospitals and the use of reliable and valid tests to assess a range of childhood functions and parents quality of life over 27 years.

There are also limitations. First, although 66% of the eligible VP/VLBW and term-born parents participated at 27 years, the dropout was not random. This is found in many longitudinal studies [39] but VP/VLBW or term born offspring that participated or dropped out did not differ on neonatal characteristics. We controlled for factors that were found to differ between parents who dropped out and stayed or found to differ between participating VP/VLBW and control parents. Simulations have further shown that even when dropout is selective or correlated with the outcome of interest, regression functions may alter only marginally [40] but it cannot be excluded.

Conclusions

Twenty-seven years after birth, parents of VP/VLBW born adults have similar quality of life as compared to parents of term born adults. This is a testament to resilience, adaptability and coping and important new information for counselling of parents of VP/VLBW born children dealing with disability and schooling problems in childhood. Parents' quality of life was mainly affected by their offspring's mental health and relationships with peers in childhood

rather than by their child being born VP/VLBW or having disabilities or poor school performance. Support and interventions to improve mental health and peer relationships in all children is likely to positively affect both the children as they grow up and the parents' quality of life and may reduce health related costs.

Future research of very preterm children may want to plan to include similar parent quality of life outcome measures to allow for comparisons across different samples to determine whether the findings reported here are specific to variations of neonatal treatment, social conditions in countries or health systems or universal as has been recently reported for other outcomes. [34,41,42,43]

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Figure 1. Flow diagram of eligible sample of VP/VLBW and term control participants in adulthood and their parents

Figure 2. Parental overall quality of life factor score (QoL) distribution and means (black line) in the VP/VLBW and term control group

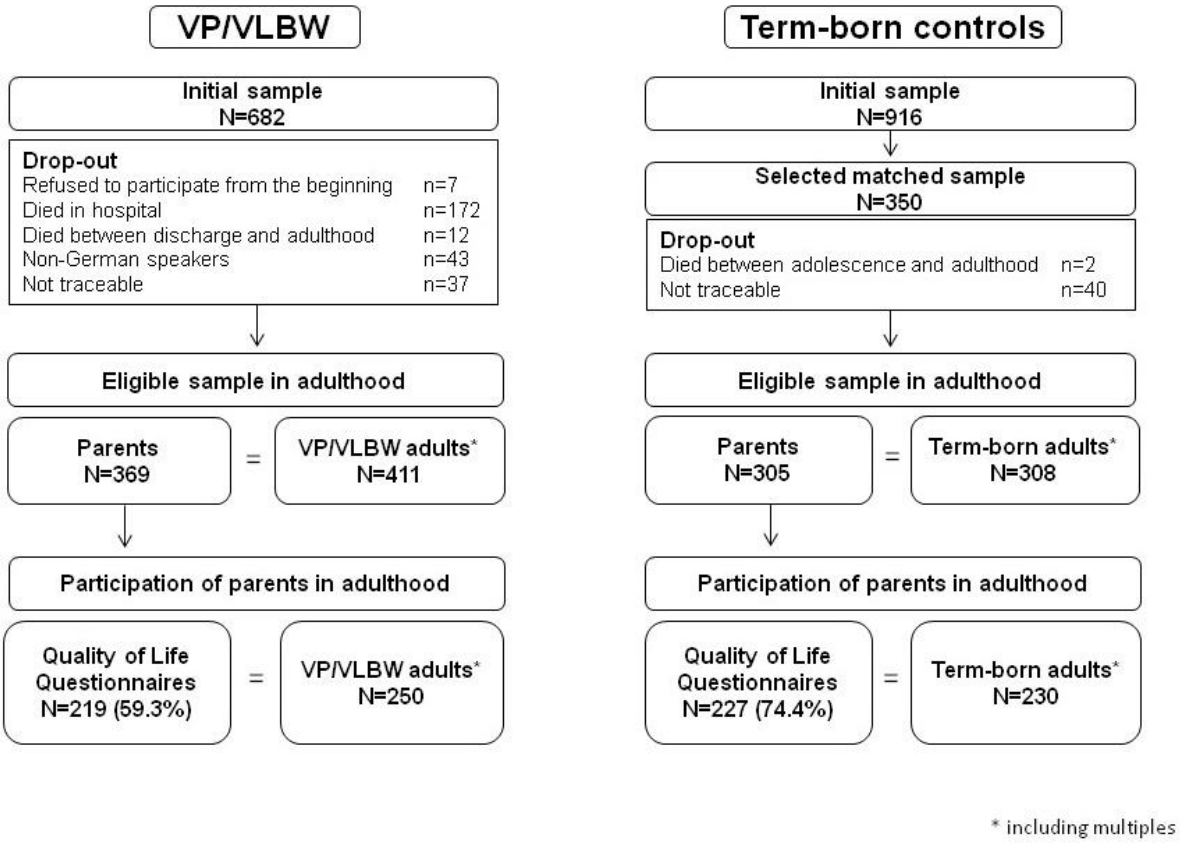

Figure 1. Flow diagram of eligible sample of VP/VLBW and term control participants in adulthood and their parents

Table 1. Family demographics and child functioning in the VP/VLBW and term born control group

	VP/VLBW	**Term controls**	***p-value***
Parental demographics	**N=219**	**N=227**	
Parental sex, n (%)			**0.04**
Mother	192 (87.7)	212 (93.4)	
Father	27 (12.3)	15 (6.6)	
Current parental age, mean (95% CI)	56.1 (55.4, 56.8)	56.4 (55.8, 57.0)	0.51
Family socioeconomic status at birth, n (%)			**0.02**
High	47 (21.6)	77 (33.9)	
Middle	105 (48.2)	92 (40.5)	
Low	66 (30.3)	58 (25.6)	
Maternal age at birth, mean (95% CI)	28.6 (27.9, 29.2)	29.1 (28.5, 29.7)	0.27
Paternal age at birth, mean (95% CI)	31.7 (30.9, 32.5)	32.4 (31.6, 33.2)	0.20
Marital status at birth (married/cohabiting), n (%)	200 (94.3)	222 (97.8)	0.06

Current marital status (married/cohabiting), n (%)	151 (73.7)	184 (82.1)	**0.03**
Maternal depression (DSM-IV diagnosis) at 6 or 8 years, n (%)	10 (5.3)	27 (11.9)	**0.02**
Offspring's neonatal characteristics	**N=250**	**N=230**	
Sex, n (%)			0.21
Female	116 (46.4)	120 (52.2)	
Male	134 (53.6)	110 (47.8)	
Gestation (weeks), mean (95% CI)	30.4 (30.2, 30.7)	39.6 (39.5, 39.8)	**<0.001**
Birth weight (g), mean (95% CI)	1304 (1265, 1344)	3374 (3316, 3433)	**<0.001**
Multiple birth, n (%)	73 (29.2)	9 (3.9)	**<0.001**
Offspring's childhood functioning up to 13 years	**N=250**	**N=230**	
Any disability, n (%)	97 (38.8)	13 (5.7)	**<0.001**
Mental health*, mean (95% CI)	-0.08 (-0.16, -0.01)	0.09 (0.01, 0.16)	**0.002**
Academic achievement*, mean (95% CI)	-0.40 (-0.52, -0.28)	0.42 (0.35, 0.49)	**<0.001**

Parent-child relationship*, mean (95% CI)	-0.10 (-0.16, -0.03)	0.10 (0.05, 0.16)	**<0.001**
Peer relationships*, mean (95% CI)	-0.13 (-0.19, -0.06)	0.13 (0.07, 0.18)	**<0.001**

* standardized factor score

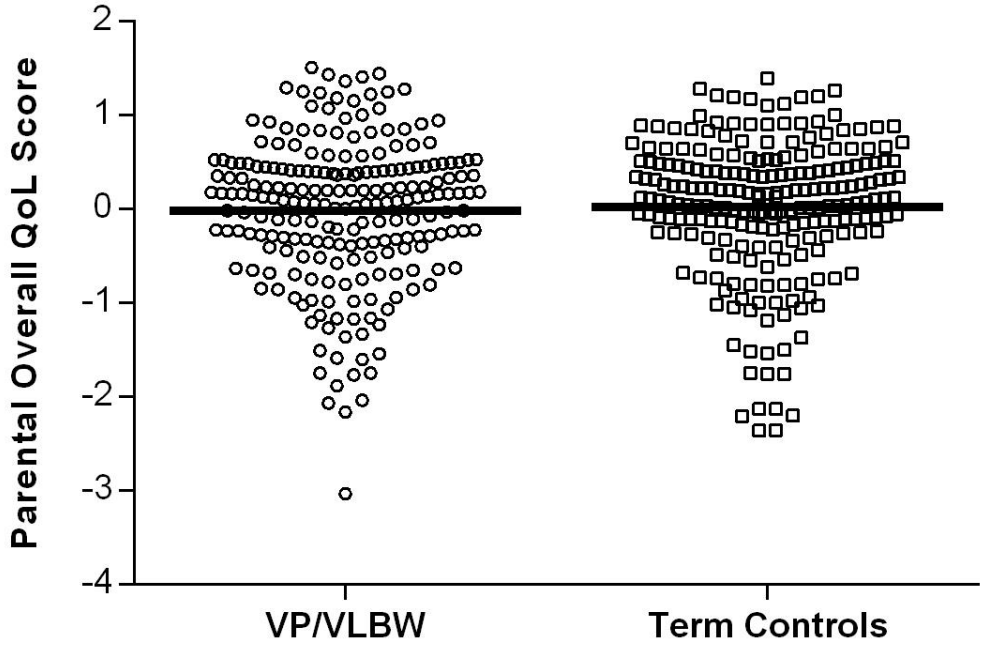

Figure 2. Parental overall quality of life factor score (QoL) distribution and means (black line) in the VP/VLBW and term control group

Table 2. Parental quality of life outcomes in the VP/VLBW and term control group: Sub-domain total scores

	VP/VLBW N=219	**Term controls N=227**	
	mean (95% CI)	*mean (95% CI)*	*p-value*
WHO Quality of Life			
Global score of quality of life & general health	69.6 (67.1, 72.0)	73.7 (71.4, 76.0)	0.02
Physical health	80.1 (78.1, 82.0)	80.0 (78.0, 82.0)	0.97
Psychological	74.7 (72.9, 76.4)	73.0 (71.4, 74.6)	0.17
Social relationships	72.8 (70.6, 75.0)	73.9 (71.9, 76.0)	0.46
Environment	82.3 (80.7, 83.8)	82.3 (80.9, 83.7)	0.99
Life satisfaction (global score)	26.2 (25.5, 26.9)	26.9 (26.2, 27.5)	0.18

Note. None significant according to Bonferroni correction (p>0.008)

Table 3. Unadjusted and adjusted associations between child functioning and parental overall quality of life

	unadjusted impact			adjusted impact*		
	B	*95% CI*	*p-value*	*B*	*95% CI*	*p-value*
Parental overall quality of life						
VP/VLBW versus Term born	0.07	(-0.09, 0.24)	0.38	0.07	(-0.10, 0.24)	0.40
Any disability	0.01	(-0.21, 0.23)	0.96	-0.02	(-0.24, 0.20)	0.87
Mental health	0.15	(0.08, 0.22)	**<0.001**	0.15	(0.08, 0.22)	**<0.001**
Academic achievement	-0.02	(-0.07, 0.04)	0.61	-0.03	(-0.09, 0.04)	0.40
Parent-child relationship	0.02	(-0.05, 0.08)	0.59	0.02	(-0.05, 0.08)	0.65
Peer relationship	0.10	(0.03, 0.16)	**0.004**	0.09	(0.02, 0.16)	**0.008**

* Adjusted for all child functioning domains, socioeconomic status, multiple birth, parental sex of informant, maternal depression (DSM-IV diagnosis) at 6 or 8 years, maternal age and marital status at birth

Supplemental Information

Supplementary Table S1. Parental quality and satisfaction of life scales and their factors loadings on the overall Quality of Life factor (Mplus 7.3 confirmatory factor analysis)

Supplementary Table S2a: Description of indicators used to define any disability in childhood

Supplementary Table S2b: Description of measures used as indicators of child functioning domains

Supplementary Table S3. Domains of mental health, academic achievement, parent child relationship and peer relationships and factor loadings on these domain factors (Mplus 7.3 confirmatory factor analysis)

Supplementary Table S4. Comparison of family demographics of those who participated and those who were lost to follow up

Supplementary Table S5. Unadjusted and adjusted associations between child functioning and parental quality of life (WHOQoL global and domain scores and Life satisfaction scale)